CLAIMS

What is claimed is:

1. A side-slip velocity estimation module for a vehicle stability enhancement control system, comprising:

a side-slip acceleration estimation module that determines an estimated side-slip acceleration of a vehicle, said side-slip acceleration module having an estimated side-slip acceleration signal associated therewith; and

a limited-frequency integrator that integrates the estimated side-slip acceleration to determine an estimated side-slip velocity of the vehicle, said limited frequency integrator having a feedback loop, the feedback loop comprising a cutoff frequency; wherein the cutoff frequency is determined in relation to a speed of the vehicle and the estimated side-slip acceleration.

2. The side-slip velocity estimation module of claim 1, wherein the estimated side-slip acceleration is determined based on a yaw rate, a lateral acceleration, and the speed of the vehicle.

3. The side-slip velocity estimation module of claim 1, further comprising:

a reset logic module that clears an output of said limited-frequency integrator when a first condition occurs.

4. The side-slip velocity estimation module of claim 3, wherein the first condition is a straight-driving condition that is determined based on a yaw rate, a lateral acceleration, and an angle of a steering wheel of the vehicle.

5. The side-slip velocity estimation module of claim 3, wherein the first condition is a speed condition that is based on the speed of the vehicle.

6. The side-slip velocity estimation module of claim 3, wherein the first condition is a sensor bias condition that is based on the estimated side-slip acceleration.

7. The side-slip velocity estimation module of claim 1, wherein the cutoff frequency of said limited-frequency integrator is determined in relation to a vehicle speed threshold, and wherein if the speed of the vehicle is less than the vehicle speed threshold, the cutoff frequency is set to a predetermined minimum frequency, and wherein if the speed of the vehicle is greater than or equal to the vehicle speed threshold, the cutoff frequency is determined in relation to the estimated side-slip acceleration.

8. The side-slip velocity estimation module of claim 7, wherein the cutoff frequency is determined in relation to the estimated side-slip acceleration using a fast Fourier transform of the estimated side-slip acceleration signal to determine the frequency content thereof.

9. The side-slip velocity estimation module of claim 8, wherein the cutoff frequency is determined from a minimum of the frequency content of the fast Fourier transform of the estimated side-slip acceleration signal.

10. The side-slip velocity estimation module of claim 9, wherein the cutoff frequency is determined in relation to a predetermined side-slip acceleration threshold, and wherein if the estimated side-slip acceleration of the vehicle is less than the predetermined side-slip acceleration threshold, the cutoff frequency is set to the minimum of the frequency content, and wherein if the estimated side-slip acceleration of the vehicle is greater than or equal to the predetermined side-slip acceleration threshold, the cutoff frequency is set to the minimum of the frequency content factored by a frequency correction factor for values of the frequency correction factor less than 1, and for all other values of the frequency correction factor is set to the minimum of the frequency content.

11. The side-slip velocity estimation module of claim 1, wherein the estimated side-slip velocity is compared to a desired side-slip velocity to produce a side-slip control signal.

12. The side-slip velocity estimation module of claim 11, wherein the side-slip control signal is combined with a yaw rate control signal to produce an actuator control signal.

13. The side-slip velocity estimation module of claim 12, wherein the actuator control signal is received by at least one brake actuator that applies a brake pressure difference across at least one axle of the vehicle to create a yaw moment to correct a dynamic behavior of the vehicle.

14. The side-slip velocity estimation module of claim 12, wherein the actuator control signal is received by a rear-wheel steering actuator that turns a set of rear wheels of the vehicle to create a yaw moment to correct a dynamic behavior of the vehicle.

15. A method of side-slip velocity estimation for a vehicle stability enhancement control system, comprising the steps of:

determining an estimated side-slip acceleration of a vehicle; and

integrating the estimated side-slip acceleration to determine an estimated side-slip velocity of the vehicle, wherein the estimated side-slip acceleration is integrated with a limited-frequency integrator having a feedback loop, the feedback loop comprising a cutoff frequency; wherein the cutoff frequency is determined in relation to a speed of the vehicle and the estimated side-slip acceleration..

16. The method of claim 15, wherein the estimated side-slip acceleration is determined based on a yaw rate, a lateral acceleration, and the speed of the vehicle.

17. The method of claim 15, further comprising a step of:
clearing an output of the limited-frequency integrator when a first condition occurs.

18. The method of claim 17, wherein the first condition is a straight-driving condition that is determined based on a yaw rate, a lateral acceleration, and an angle of a steering wheel of the vehicle.

19. The method of claim 17, wherein the first condition is a speed condition that is based on the speed of said vehicle.

20. The method of claim 17, wherein the first condition is a sensor bias condition that is based on the estimated side-slip acceleration.

21. The method of claim 15, further comprising:
determining the cutoff frequency of the limited-frequency integrator in relation to a vehicle speed threshold, wherein if the speed of the vehicle is less than the vehicle speed threshold, the cutoff frequency is set to a predetermined minimum frequency, and wherein if the speed of the vehicle is greater than or equal to the vehicle speed threshold, the cutoff frequency is determined in relation to the estimated side-slip acceleration.

22. The method of claim 21, further comprising:
determining the cutoff frequency in relation to the estimated side-slip acceleration using a fast Fourier transform of an estimated side-slip acceleration signal to determine the frequency content thereof.

23. The method of claim 22, further comprising:
determining a minimum of the frequency content of the fast Fourier transform of the estimated side-slip acceleration signal.

24. The method of claim 23, further comprising:

determining the cutoff frequency in relation to a predetermined side-slip acceleration threshold, wherein if the estimated side-slip acceleration of the vehicle is less than the predetermined side-slip acceleration threshold, the cutoff frequency is set to the minimum of the frequency content, and wherein if the estimated side-slip acceleration of the vehicle is greater than or equal to the predetermined side-slip acceleration threshold, the cutoff frequency is set to the minimum of the frequency content factored by a frequency correction factor for values of the frequency correction factor less than 1, and for all other values of the frequency correction factor is set to the minimum of the frequency content.

25. The method of claim 17, further comprising:
comparing the estimated side-slip velocity to a desired side-slip velocity to produce a side-slip control signal.

26. The method of claim 25, further comprising:
combining the side-slip control signal with a yaw-rate control signal to produce an actuator control signal.

27. The method of claim 26, further comprising:
transmitting said actuator control signal to at least one brake actuator; and
applying a brake pressure difference across at least one axle of said vehicle to create a yaw moment to correct a dynamic behavior of the vehicle.

28. The method of claim 26, further comprising:
transmitting the actuator control signal to a rear-wheel steering actuator; and
turning a set of rear wheels of said vehicle to create a yaw moment to correct a dynamic behavior of the vehicle.